COVER SHEET FOR TRITIUM SELF-LUMINOUS EXIT SIGN MATERIAL

NEVADA LICENSE (MANUFACTURING PERMIT)

NEVADA LICENSE (DISTRIBUTION PERMIT)

ANSI/HPS TEST STANDARD (N43.4-2000)

FORMAL TEST RESULTS AGAINST N43.4-2000

UNDERWRITERS LABORATORIES AUTHORIZATION

The following documents constitute the manufacturing and distribution licenses from the State of Nevada required by the U.S.N.R.C. that allow Forever-Lite, Inc. to produce and distribute self-luminous exit signs. Also included in this set of documents is the actual ANSI/HPS standard (N43.4-2000) which defines the tests to be performed on the product to assure that quality and safety issues are met at the highest level.

The next document is a copy of the test scores resulting from subjecting the product to N43.4-2000. In Table 1, page 2 of the Test Report, the Observation column describes the result of the individual test section while the column titled "Requirements" spells out the result of the individual test. In all cases, the Forever-Lite, Inc. self-luminous exit sign exceeded the minimum requirement by the widest margin possible. Note that section 7.2, 7.8 and 8.2 test results demonstrate extreme compliance with the published standard while on all other test sections, there was absolutely no evidence of actual or potential failure of the sign.

The Forever-Lite, Inc. self-luminous exit sign is in 100% compliance with N43.4-2000.

Finally, a copy of the authorization letter from Underwriters Laboratories permitting Forever-Lite, Inc. to label the tritium powered exit signs with the UL approved marking.

Amendment No. 10 amends license No. 03-11-0494-02 in its entirety

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

Pursuant to Nevada Revised Statute 459.030 and Nevada Administrative Code 459.196 and in reliance on statements and representations heretofore made by the licensee designated below a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material designated below and to use such radioactive material for the purpose(s) and at the location(s) designated below. This license is subject to all applicable rules, regulations, and orders now or hereafter in effect and to any conditions specified below.

1. Name:	Best Lighting Products, Inc. dba Foreverlite, Inc.	3. License Number:	03-11-0494-02
2. Address:	6865 Speedway Blvd, Suite Q108 Las Vegas, NV 89115	4. Expiration Date:	November 30, 2011
		5.	

Amendment No. 7 amends license No. 03-11-0494-01 in its entirety.

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

Pursuant to Nevada Revised Statute 459.030 and Nevada Administrative Code 459.196 and in reliance on statements and representations heretofore made by the licensee designated below a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material designated below and to use such radioactive material for the purpose(s) and at the location(s) designated below. This license is subject to all applicable rules, regulations, and orders now or hereafter in effect and to any conditions specified below.

1. Name:	Best Lighting Products, Inc. dba Foreverlite, Inc.	3. License Number:	03-11-0494-01
2. Address:	6865 Speedway Blvd, Suite Q108 Las Vegas, NV 89115	4. Expiration Date:	November 30, 2011
		5.	

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

SUPPLEMENTARY SHEET

Continued . . .

13. Sealed sources possessed under this license shall be swipe tested if a broken and/or damaged sealed source is identified or suspected. The swipe test must be analyzed by persons specifically licensed by the division, the U.S. Nuclear Regulatory Commission or an Agreement State.

14. The licensee shall conduct a physical inventory every six months to account for all sealed sources and/or devices received and possessed under the license. Records of the inventories shall be maintained for inspection, and may be disposed of following Division inspection.

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. Nevada Administrative Code (NAC) 459 shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Application received October 10, 2001.
    B. Letter dated November 8, 2001, signed by Max Malone.

November 16, 2001

Stanley R. Marshall, Supervisor
Radiological Health Section
Bureau of Health Protection Services
Nevada State Health Division

SM\lb\ram\best lighting 01 lic

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

Pursuant to Nevada Revised Statute 459.030 and Nevada Administrative Code 459.196 and in reliance on statements an representations heretofore made by the licensee designated below a license is hereby issued authorizing such licensee to transfe receive, possess and use the radioactive material designated below and to use such radioactive material for the purpose(s) and at th location(s) designated below. This license is subject to all applicable rules, regulations, and orders now or hereafter in effect and to an conditions specified below.

1. Name:	Best Lighting Products, Inc.	3. License Number:	03-11-0494-02
2. Address:	201 East Stevens Avenue Santa Ana, CA 92707	4. Expiration Date:	November 30, 2006
		5.	

6. Radioactive material:	7. Chemical and/or physical form:	8. Maximum quantity licensee may possess at any one time:
A. Hydrogen 3	A. Sealed source (Surelite Limited Model 700C series)	A. Not applicable

9. Authorized Use

A. The licensee is authorized to distribute the devices containing sealed sources specified in Condition 11 of the license to generally licensed persons pursuant to the Nevada Administrative Code (NAC) 459.282.

10. Radioactive material shall be distributed only from at the licensee's facility located at 6775 Speedway Blvd., Suites M-102/M-103, Las Vegas, Nevada 89115.

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

SUPPLEMENTARY SHEET

'Continued . . .

License Number 03-11-0494-02

11. The following table lists the devices which the licensee is authorized to distribute pursuant to the terms and conditions of this license. Column 1 lists the device model number, and colums 2 and 3 identify the manufacturer, model number, and maximum activity of the sealed source(s).

	Device Model	Sealed Source Manufacturer/Model No.	Activity
a.	SLXTU N C H YY	Surelite Limited, Model 700C series	11.4 curies

12. The devices authorized for distribution under Item 9 of this license shall be only those devices which are manufactured under Nevada Radioactive Material License No. 03-11-0494-01 and are described in the following documents:

a. Application received October 10, 2001.
b. Letter dated November 8, 2001, signed by Max Malone.
c. The Sealed Source and Device Registry certificate CA1140D101G.

13. The Radiation Safety Officer for activities authorized under this license shall be E. Maxwell Malone.

14. This license does not authorize possession or use of radioactive material.

15. The licensee shall report all transfers of radioactive material under this license. Reports shall be filed with the regulatory agencies having jurisdiction over the recipients of the radioactive material. Reports to each agency shall be filed within 30 days after the end of each calendar quarter in which applicable tranfers have occurred. The reports shall specify:

a. The name and address of the regulatory agency to whom the report is directed;
b. The authority for transfer, i.e., the name of the licensee specified in Item 1 of this license, and the license number specified in Item 3 of this license;
c. The name, address, and phone number of the generally licensed recipient (for the contact person and location of use);
d. The number of devices and specific model number and serial number of devices, together with an indication of the nuclides and aquantities contained in each device transferred to each generally license recipient.

Copies of all reports reaquired by this condition shall be maintained for inspection by the Division.

NEVADA STATE HEALTH DIVISION

RADIOACTIVE MATERIAL LICENSE

SUPPLEMENTARY SHEET

License Number 03-11-0494-02

Continued . . .

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. Nevada Administrative Code (NAC) 459 shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application received October 10, 2001.
B. Letter dated November 8, 2001, signed by Max Malone.

November 16, 2001

Stanley R. Marshall, Supervisor
Radiological Health Section
Bureau of Health Protection Services
Nevada State Health Division

SM\lb\ram\best lighting 02 lic

ANSI/HPS N43.4-2000

#36

American National Standard –

Classification of Radioactive Self-Luminous Light Sources

Approved – September 7, 2000
American National Standards Institute, Inc.

Contents

Tables

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state in their own advertising, promotional material, on tags or labels, that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE. This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five (5) years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 11 West 42nd Street, New York, New York 10036.

Foreword (This foreword is not a part of American National Standard Classification of Radioactive Self-Luminous Light Sources, N43.4)

The radiation from radioactive material is used as a source of energy for activating phosphors to produce light in self-luminous watches and clocks, instrument dials, aircraft exit markers, luminous switches, etc. Safety in the design and use of radioactive materials in self-luminous products continues to be of concern to the industry, regulatory bodies and the general public.

In 1967 Committee N43 was organized under the sponsorship of the National Bureau of Standards (now the National Institute of Standards and Technology) to replace Sectional Committee Z54. The scope of the new committee is "standards pertaining to products and equipment, for non-medical scientific, industrial, and educational uses, involving ionizing radiation sources including radioactive materials, accelerators, and x-ray equipment but excluding nuclear reactors."

The responsibility to develop standards for self-luminous sources was assigned to Subcommittee N43-2. In 1975 a standard for classification of radioactive self-luminous light sources was approved by the USA Standards Committee N43-2 Subcommittee and published as American National Standard N-540 (NBS Handbook 116), issued January 1976. This standard was reaffirmed as ANSI 43.2 (R1989). In 1985 Committee N43 was organized under the sponsorship of the Health Physics Society. This standard is an elaboration and refinement of ANSI N-540 for self-luminous sources. The N43.4 Working group is responsible for preparing this standard.

In 1997 a standard for Classification of Sealed Radioactive Sources was issued by the Health Physics Society Committee N43.6, was approved November 1997 and issued in 1998, in which some performance requirements for self-luminous devices were provided.[a]

[a] Figures in brackets refer to the reference listed in Section 10 of this standard.

Realizing that questions may arise from time to time concerning interpretations of this standard, provisions have been made for an Interpretations Committee in order that uniform handling of questionable cases may be provided. It is recommended that anyone using this standard and desiring an interpretation of a questionable case communicate with the Health Physics Society. Suggestions for improvement gained in the use of this standard shall be welcome. They should be sent to the Health Physics Society, 1313 Dolly Madison Blvd., Suite 402, McLean, VA 22101.

Members of Subcommittee N43-4 which had responsibility for the development of ANSI N-540-1975 (NBS Handbook 116) are listed below:

Robert F. Barker, Secretary
Arthur C. Chandler, Jr.
Harry H. Dooley, Chairman
Major Fecteau
Marvin E. Gonshery
Will Hegarty
Elmer Hites
Warren M. Holm
Alphus L. Jones
James C. Malaro
Robert C. McMillan
Donald McSparron
Walter T. Neal
Gail Schmidt
R.F. Stewart
Darwin Taras
C.W. Wallhausen
Richard N. Walz

Members of Subcommittee N43.4 which had responsibility for the development of ANSI/HPS N43.4-2000 are listed below:

David P. Alberth
Gordon M. Lodde, Chairman
Frances Szrom

This standard was consensus balloted and approved by the ANSI-Accredited HPS N43 Committee on March 28, 2000. At the time of balloting, the HPS N43 Committee had the following membership:

Chair	John C. Taschner
Vice Chair	Gordon M. Lodde
ABB Industrial Systems Inc.	John R. Dukes
Alliance of American Insurers	Thomas F. Bresnahan
American Automobile Manufacturers Association	Donald A. Greschaw
	William Watt (alt.)
American Conference of Governmental Industrial Hygienists	David A. Felinski (alt.)
American Crystallographic Association	Gordon M. Lodde
American Insurance Services Group	Camden Hubbard
American Iron and Steel Institute	Stewart M. Fastman
	Anthony LaMastra
American Public Health Assoc., Inc.	Peter A. Hernandez (alt.)
American Society for Nondestructive Testing, Inc.	Jesse Lieberman
American Society for Testing and Materials	K. Dieter Markert
American Welding Society	Marvin M. Turkanis
Atomic Energy Control Board	Edward L. Criscuolo
Conference of Radiation Control Program Directors	R. E. Irwin
	Mike Henry
Health Physics Society	Bart Lago (alt.)
	Jack Fix
National Institute of Standards and Technology	David Lee (alt.)
	Douglas M. Eagleson
Underwriters' Laboratories, Inc.	James W. Tracy (alt.)
	Peter Boden
Univ. of California (Los Alamos Nat'l Lab)	David Dini (alt.)
U. S. Dept of the Air Force, Office of the Surgeon General	John C. Taschner
U. S. Dept of the Army, Office of the Surgeon General	Don Jordan
	Harris Edge
U.S. Department of Energy	Gregory R. Komp (alt.)
	Peter O'Connell
U. S. Department of the Navy	Joel Rabovsky (alt.)
	David E. Farrand
	William Morris (alt.)
U. S. Dept of Health and Human Services - Public Health	Steven Doremus (alt.)
	H. Thompson Heaton
Individual Members	Frank Cerra (alt.)
	John H. Weiler

This standard establishes the classification of certain radioactive self-luminous light sources according to radionuclide, type of source, activity, and performance requirements. The objectives are to establish minimum prototype testing requirements for radioactive self-luminous light sources, to promote uniformity of marking such sources, and to establish minimum physical performance for such sources. This standard is primarily directed toward assuring adequate containment of the radioactive material. Testing procedures and classification designations are specified for discoloration, temperature, thermal shock, reduced pressure, impact, vibration, and immersion. A range of test requirements is presented according to intended usage and source activity.

Key words: Classification; designation; containment; light sources; national standard; radiation source; radioactive; radioluminous products; self-luminous sources; test procedures.

Classification of Radioactive Self-Luminous Light Sources

1. Scope

This standard establishes the classification of certain radioactive self-luminous light sources according to radionuclide, type of source, activity and performance requirements. The standard does not attempt to establish design or safety standards, but leaves the design features to the judgment of the supplier and user, provided that the performance requirements are met.

This standard does not specify the luminance of the self-luminous light source; however, many of these sources are used for safety proposes. Therefore, the luminosity must be commensurate with the intended use of the source(s).

Note: Radioactive self-luminous light sources used in or on timepieces are not covered by this standard.

The objectives of this standard are to establish minimum prototype testing requirements for radioactive self-luminous light sources, to promote uniformity of marking such sources, and to establish minimum physical performance for such sources.

This standard is primarily directed toward assuring adequate containment of the radioactive material. Other factors, such as quality control, external radiation levels, radiotoxicity of the radionuclide, its chemical and physical form, and quantity of radioactive material in the source, also shall require consideration in view of the ever present objective of keeping exposures as low as is reasonably achievable (ALARA). Compliance with this standard does not necessarily satisfy all requirements for manufacture and use which may be imposed by governmental regulatory agencies.

2. Definitions

The definitions and terms contained in this standard, or in other American National Standards referred to in this document, are not intended to embrace all legitimate meanings of the terms. They are applicable only to the subject treated in this standard.

Activity: The number of spontaneous nuclear transformations occurring in a given quantity of material during a suitably small interval of time divided by that interval of time. It is commonly expressed in curies (Ci). The SI unit for activity is the becquerel (Bq). One Ci is equal to 3.7×10^{10} Bq.

Brightness (or luminance): The luminous intensity of the surface of a self-luminous light source in a given direction per unit projected area of the surface, viewed from that direction. Luminance is measured in candela per square meter.

Capsule: A protective envelope used to prevent leakage of the radioactive material.

Container: A general term to designate any enclosure which surrounds the encapsulated radioactive material.

Device: Any piece of equipment designed to utilize self-luminous light source(s).

Distributor: Any person or organization supplying self-luminous light sources.

Fixed Sources: Sources intended for usage at a specific location(s), designed for environmental conditions existing at the intended location(s), and to be used, except for accidental or unavoidable circumstances, under environmental conditions for which the source was designed.

Leakage: A transfer of radioactive material from the self-luminous light source to the environment external to any encapsulation.

Manufacturer: Any person or organization fabricating a self-luminous light source(s).

Mobile Sources: Sources designed to meet certain anticipated environmental conditions, not necessarily intended for usage at any, specific location(s), and known to be subject to possibly frequent or severe environmental changes.

Model: Descriptive term or number to identify a specific self-luminous light source design.

Non-Leachable: Term used to convey that the radioactive material is virtually insoluble in water and not convertible into dispersible products.

Prototype Source: The original of a model of a source that serves as a pattern for the manufacture of all sources identified by the same model designation.

Prototype Testing: The performance testing of a new source design before sources of such design are put into actual use.

Quality Control: Such tests and procedures as are necessary to establish that the sources comply with the performance characteristics for that source design as defined in Table 3 of this standard.

Radiotoxicity: The toxicity attributable to the radiation emitted by a radioactive substance within the body.

Self-Luminous Light Source: A source consisting of a radioactive nuclide(s) firmly incorporated in solid and/or inactive materials, or sealed in a protective envelope strong enough to prevent any leakage of the contained radioactive substances to the environment under ordinary circumstances of use and incorporating a phosphor for the purpose of emitting light. Self-luminous light sources include:

Dry powder sources: in which the activated phosphor is introduced into a sealed container without the use of any binding medium,

Gaseous sources: in which the phosphor is coated on the inside wall of or on a component within the container in which the radionuclide, in gaseous form, is contained,

Painted sources: in which a radionuclide is intimately mixed and bound with the phosphor and incorporated into a capsule, and

Separable sources: in which the radionuclide, bonded to or in a supporting strata, and the phosphor constitute independent elements, which can be isolated from each other.

Shall: Where "shall" is used for a provision specified herein, that provision is intended to be a requirement.

Should: Where "should" is used to indicate provisions which are not required but which are here recommended as good practice.

Source Holder: A mechanical support for the self-luminous light source.

3. General Conditions

Self-luminous light sources, considered in this standard, are of four general types: dry powder sources, gaseous sources, painted sources, and separable sources.

3.1 Activity Level (Table 1)

Table 1 establishes the maximum activity of an individual classification of each type of source under this standard. The radionuclides most commonly used and those exhibiting potential use in self-luminous sources are listed in Table 1.

3.2 Self-Luminous Light Source Performance Tests (Table 2)

Table 2 provides a listing of the tests for evaluating the physical performance of self-luminous sources under average environmental conditions in which a self-luminous source, or source-device, shall be used. The tests are based on normal and abnormal use (typical accidents considered) but do not include exposure to fire or explosion. The tests shall be run consecutively, in the order shown in Table 2.

Table 2 does not cover all source-use situations. If the environmental conditions to which a source is expected to be exposed in use differ from the particular environment shown, the specifications for the source and the test requirements shall be considered on an individual basis by the supplier, the user, and the

Table 1. Maximum Activity in Curies* of an Individual Self-Luminous Light Source

Radionuclide	Dry Powder	Painted	Separable	Gaseous
Tritium H-3	1	5	5	50[a]
Carbon C-14	0.06	0.3	0.3	30 (CO_2)
Chlorine Cl-36	0.006	0.03[b]	0.03	3
Nickel Ni-63	0.06	0.3	0.3	-
Krypton Kr-85	0.006[c]	0.03[c]	0.03[c]	30
Technetium Tc-99	0.06	0.3	0.3	-
Promethium Pm-147	0.06	0.3	0.3	-
Thallium Tl-204	0.006	0.03	0.03	-
Lead Pb-210	0.0003	0.0015	0.0075	-
Radium Ra-226	0.00002	0.0001	0.0005	-
Thorium Th-230	0.00002	0.0001	0.0005	-
Americium Am-241	0.00002	0.0001	0.0005	-

* One Ci is equal to 3.7×10^{10} Bq.

[a] Tritium oxide content shall not exceed the greater of (a) 0.01 percent of tritium in source, or (b) 1 mCi. 1% or (0.01)

[b] Cl Salt

[c] Kryptonate (Krypton is a gas at the operating temperature of the self-luminous devices.)

Table 2. Self-Luminous Light Source Performance Tests

Type of Test[a]	Performance Test Levels				
	1	2	3	4	X[b]
Discoloration	12 h lamp	(c)	(c)	(c)	Special
Temperature	No Test	0 °C and 50 °C	-30 °C and 65 °C	-55 °C and 80 °C	Special
Thermal Shock	No Test	0 °C to 50 °C	-30 °C to 65 °C	-55 °C to 80 °C	Special
Pressure (Reduced)	No Test	226 mm Hg abs.	175mm Hg abs.	87 mm Hg abs.	Special
Impact	No Test	Free fall to steel plate 1m; 2x	Free fall to steel plate 1m; 20x	Free fall to steel plate 1m; 20x and 3m; 2x	Special
Vibration	No Test	Simple harmonic motion having an amplitude of 0.075 cm (0.03") or an amplitude of 0.75 cm (0.3") and a maximum total excursion of 0.15 cm (0.06"), the frequency being varied uniformly between the approximate limits of 10 Hz and 55 Hz and return to 10 Hz, shall be traversed in approximately one (1) minute.			Special
		10 minutes	30 minutes	60 minutes	
Immersion	No Test	Immersion in cold bath, 15 minutes. Immediate (one minute max) transfer to hot bath, 15 minutes. Immediate (one minute max) transfer to cold bath. A dye may be used to observe obvious, gross penetration.			Special
		0 °C to 50 °C 2 cycles	0 °C to 65 °C 2 cycles	0 °C to 80 °C 5 cycles	

a. Tests to be performed in the order shown. All temperatures specified ±3°C

b. Test Level X used for environmental conditions more sever than the test conditions of level 4.

Table 3. Performance Standards for Classification of Self-Luminous Light Sources[a]

Source Activity (% of Table 1)[b]	Intended usage	Classification	Performance test level (Table 2)						
			Discoloration	Temperature	Thermal Shock	Pressure (reduced)	Impact	Vibration	Immersion
≤0.1%	any	1	1	1	1	1	1	1	1
≥0.1% to ≤1%	any	2	1	2	2	2	2	2	2
≥1% to ≤10%	fixed	3	1	3	3	3	2	2	2
	mobile	4	1	3	3	3	3	3	3
≥10% to ≤100%	fixed	5	1	3	3	3	3	3	3
	mobile	6	1	3	3	3	3	4	4
< Table 1	maximum normal environment	7	1[c]	4[c]	4[c]	4[c]	4[c]	4[c]	4[c]

a. The above figures are minimum requirements for applications involving normal usage. Where special environmental conditions are involved, either more or less stringent than what might be considered normal, the user shall specify the abnormal condition or conditions, or request the necessary class change.

b. Source activity as a percent of Table 1.

c. Or "Special," as required for specific abnormal environmental condition(s). Use an X where applicable to indicate the special test(s).

regulating authority. If the environmental conditions are more severe than the test conditions of Level 4 in Table 2, "special" tests shall be developed by the supplier, which satisfy the user and the regulating agency.

3.3 Performance Standards for Classification of Self-Luminous Light Sources (Table 3)

Table 3 establishes test requirements for self-luminous light sources according to intended usage and source activity. These performance requirements are minimums for applications involving normal usage (including typical accidents). Where generally extreme environmental conditions may be encountered, a "special" test appropriate to that situation shall be developed. There also may be situations where a source in its intended usage shall encounter only one extreme environmental condition. Under such a condition the general classification shall be modified to accommodate the abnormal condition.

3.4 Fire and Explosion

Table 2 does not consider exposure of the source or source-device to fire and explosion. In the evaluation of self-luminous light sources and source-devices, the manufacturer and user shall consider the probability of fire and explosion and the possible results. Factors which should be considered in determining the need for tests more stringent than those suggested for specific classes in Table 3 are: consequences of loss of activity, quantity of material in the source, radiotoxicity, physical form of the material environment in which the source is used, and protection afforded the source or source-device combination.

It is recognized that the possibility of fire or explosion exists in many areas where light sources are used. However, light sources, because of certain inherent characteristics, cannot always be constructed so as to completely resist the effects of fire or explosion. Therefore, special test requirements shall be specified where the probability of fire or explosion is known to be abnormally high. These special tests shall include temperature, thermal shock, pressure and impact resistance.

3.5 Radiotoxicity and Solubility

Except as limited by Section 3.4, radiotoxicity of the radioactive material and its solubility shall be considered only when the activity of the source exceeds the value shown in Table 1. If the activity exceeds the value shown in Table 1, the classification of the source shall be considered on an individual basis. If the activity does not exceed the values shown in Table 1, then Table 3 may be used without consideration of either radiotoxicity or solubility.

4. Classification and Testing

4.1 Classification Procedures

The performance classification of a specific type of self-luminous source or source-device shall be determined as follows:

4.1.1 Determine from Table 1 the activity allowable for that type of source.

4.1.2 If the desired quantity of radioactive material does not exceed the allowable quantity of Table 1 and no abnormal fire or explosion hazard exists, the performance requirements for classification of the type of source may be taken directly form Table 3. If a significant fire or explosion hazard exists, the factors listed in Section 3.4 shall be evaluated and applied.

4.1.3 If the desired quantity of radionuclide exceeds the allowable limits of Table 1, a separate evaluation of the specific source use and source design shall be made in accordance with Section 3.5.

4.1.4 Performance requirements may be determined directly from Table 3 for normal usage. When conditions of use indicate that abnormal resistance to one or more environmental conditions is necessary or desirable, suitable test conditions may be selected from Table 2 and substituted for those normally specified in Table 3. Since Table 3 is arranged in order of increasing severity, sources of an established classification may be used in any application

having less severe specific performance requirements.

4.2 Testing

The verification of the classification (Section 5) of each source type shall by determined by subjecting a minimum of two samples of production sources consecutively to the performance test specified, or by evaluation of prior test data on sources of comparable size and identical materials of construction.

For self-luminous light sources normally mounted in devices, the complete device should be tested. Where the source constitutes a part of a complete assembly which may not adapt to the performance test, the source only or the source in its holder should be subjected to the specified test.

Compliance with the test shall be determined by the ability of the self-luminous light source to maintain its integrity and brightness after each test is performed, i.e., retain its radioactive material and maintain, within the limits specified in Section 8, its physical and operating characteristics. In the event any of the source units fails the test series, the source design shall be considered unacceptable.

5. Classification Designation

The classification of a self-luminous light source shall be designated by a series of letters and digits in accordance with the following designation scheme:

5.1 The first one or two characters shall designate the radionuclide and, with the exception of tritium, shall consist of the chemical symbol of the element, using the letter "T" for tritium, "Kr" for krypton-85, "Pm" for promethium-147, etc.

5.2 The first character following the radionuclide identification shall be a digit, from 1 to 7, taken from Table 3, which shall indicate the classification assigned on the basis of the tests to which the source has been subjected. For emphasis, that digit shall be underlined.

5.3 The first character following identification of the general classification test shall designate
the type of source, as classified in Table 1, using the letter "D" to identify a dry powder, "P" for painted, "S" for separable and "G" for gaseous.

5.4 The first character following identification of the type of source shall indicate whether the activity (curie content) does or does not exceed the maximum amounts given in Table 1. Use the "C" to indicate that the amount does not exceed Table 1 limits and "E" to indicate that the activity exceeds Table 1 limits.

5.5 If the source testing involved any specific tests more or less stringent than normal for the indicated classification ("C" or "E"), the series shall be followed by seven additional digits to indicate the level at which each specific test was made. Table 2 shows seven tests and five test levels for each. Using the applicable designator for test levels (1 to 4 or X), indicate the deviation from the general test level in the manner illustrated in the following examples:

Assume that a source under consideration is one containing two cures of gaseous tritium, is intended for a mobile type application involving abnormal shock resistance, and has been tested in accordance with classification 4, except for the more severe impact test requirements of test level 4. The proper designation for such a source would be T4GC1333433.

The proper designator for a similar gaseous source involving no abnormal conditions and tested in accordance with the requirements of the performance standards classification 4 would be T4GC.

Accordingly, the proper designation for a 0.4 Ci tritium gas source, involving no abnormal conditions and tested in accordance with test level 2, is T2GC. If the same source had successfully been subjected to a more severe impact test, e.g., level 4, this information may be shown by the expanded designation T2GC1222422.

6. Product Identification

The ANSI classification designation shall be marked on the self-luminous light source, source container or source holder and the accompanying documents. If space limitation does not permit such marking, the classification designation shall appear on accompanying documents.

7. Performance Testing Procedures

7.1 General

The testing procedures described below are acceptable and recommended procedures for conducting the performance tests prescribed in Table 2. Procedures demonstrated to be at least equivalent are also acceptable. Tests shall be run ***consecutively*** on the same source, in the order shown in Table 2. Unless otherwise specified, the test shall be performed at 23 ± 10 °C, at barometric pressure of 710 mm -790 mm (28-31") mercury and at a maximum relative humidity of 80 percent. Temperature changes, unless otherwise specified, shall be gradual to reduce the possibility of thermal shock.

7.2 Discoloration

7.2.1 Equipment. Weatherometer or Sunlamp, Corex D filter (or equivalent), calcium chloride, 8 liters or larger, glass container.

7.2.2 Procedure. (a) Expose test sources in weatherometer for twelve hours, alternating one-half hour wet and dry cycles or, (b) expose sources for twelve hours at a distance of 20 centimeters to the light from a sunlamp, filtered by a Corex D filter (or equivalent). All tests shall be performed in air with ambient temperatures of 27 ± 10°C and a relative humidity of 95 to 100 percent. The source shall be irradiated with the light impinging on the translucent surface of the source.

7.2.3 Evaluation. Test sources shall be examined visually and any discoloration or other effects observed. The light spectrum and output after the test shall be compared with that before the test. When measured with a visual photometer or a color corrected photocell, no greater loss of luminosity than 20 percent shall be observed.

7.3 Temperature Test

7.3.1 Equipment. The heating or cooling equipment shall have a test zone volume (that volume at essentially constant temperature) of at least five times the volume of the test specimen. The temperature of the test chamber shall be determined by at least two temperature measuring instruments, which have been calibrated within the last two years, and the average of the readings shall be taken as the true temperature.

If a gas or oil-fire furnace is used for the temperature test, an oxidizing atmosphere shall be maintained at all times.

7.3.2 Procedure. All temperature tests shall be performed in air. All test sources shall be held at or above the maximum (or at or below the minimum for low temperature tests) test temperature for a period of at least one hour. The test sources shall be allowed to remain in the test chamber until they return to ambient conditions.

Sources to be subjected to temperatures below ambient shall be cooled to the test temperature in less than 45 minutes.

Sources to be subjected to temperatures above ambient shall be heated to the test temperature within a 5-minute period.

7.3.3 Evaluation. Test sources shall be examined visually for any evidence of failure and, in the absence of any evident failure, shall be used in the succeeding thermal shock test. In the event of any uncertainty regarding possible failure, the person performing the test may, at his option, subject the source (s) to the final immersion test before proceeding with the next test. See Section 8 for additional details.

7.4 Thermal Shock Test

7.4.1 Equipment. Same as Section 7.3 Temperature test.

7.4.2 **Procedure.** Use the same sources that were used in temperature test. Heat the source(s) to the maximum test temperature (required for that particular class) and hold at this temperature for at least 15 minutes. Transfer the source, in 15 seconds or less, to the cold chamber, held at or below the minimum temperature required for the particular class. If water is used for the cold test, it shall be flowing at a rate of at least ten times the source volume per minute, or, if the water is stationary, it shall have a volume of at least twenty times the source volume.

7.4.3 **Evaluation.** Test sources shall be examined visually for any evidence of failure and, in the absence of any evident failure, shall be used in the succeeding pressure test. In the event of any uncertainty regarding possible failure, the person performing the test may, at his option, subject the source(s) to the final immersion test before proceeding with the next test. See Section 8 for additional details.

7.5 Pressure (Reduced) Test

7.5.1 **Equipment.** The apparatus used for the pressure test shall consist of a vacuum pump, vented to a suitable exhaust system, and a suitable sealed chamber having means for visual observation of the sources under test. The pressure gauge shall be recently calibrated and should have a range at least 10 percent greater than the test pressure.

7.5.2 **Procedure.** The test sources shall be put into the chamber and exposed to the test pressure for four periods of 15 minutes each, the pressure being returned to atmospheric pressure between each period.

7.5.3. **Evaluation.** Test sources shall be examined visually for any evidence of failure and, in the absence of any evident failure, shall be used in the succeeding impact test. In the event of any uncertainty regarding possible failure, the person performing the test may, at his option, subject the source(s) to the final immersion test before proceeding with the next test.

7.6 Impact Test

7.6.1 **Equipment.** Rigid steel plate. Support or shelf for sources. The steel plate shall be rigidly mounted on an unyielding surface so that it shall not deflect appreciably during the test.

7.6.2 **Procedure.** Mount the source support above the steel plate at the appropriate height. Place the source to be tested on the support and, using any device or means which shall not have a tendency to orient the source, push the source from the support and allow it to free fall and impact the steel plate in a random manner. Repeat the required number of times specified for the particular test level.

7.6.3 **Source orientation.** The source shall be oriented in such a manner to assure both edge impact as well as face impact.

7.6.4 **Evaluation.** Each test source shall be examined visually for any evidence of failure and, in the absence of any evident failure, shall be used for the succeeding vibration test. In the event of uncertainty regarding possible failure, the person performing the test may, at his option, subject the source(s) to the final immersion test before proceeding with the next test. See Section 8 for additional details.

7.7 Vibration Test

7.7.1 **Equipment.** The equipment shall be capable of providing a simple harmonic motion having an amplitude of 0.075 centimeter (0.03") and a maximum total excursion of 0.15 centimeter (0.06"), the frequency being varied uniformly between the approximate limits of 10 and 55 hertz (Hz).

7.7.2 **Procedure.** Test sources shall be subjected to the above simple harmonic motion for the time interval indicated for the specific test level. The entire frequency range, between 10 and 55 Hz and return to 10 Hz, shall be traversed in approximately one (1) minute.

7.7.3 Evaluation. Test sources shall be examined visually for any evidence of failure and, in the absence of any evident failure, shall be used for the succeeding immersion test. See Section 8 for additional details.

7.8 Immersion Test

7.8.1 Equipment. Hot and cold baths.

7.8.2 Procedure. Immerse the test source(s) in a water bath, maintained at 0°C, and allow to remain for 15 minutes. Immediately (one minute maximum) transfer the sources(s) to a hot water bath, maintained at the temperature specified for the particular test level (±3 °C), and allow to remain for 15 minutes. Immediately (one minute maximum) transfer to the cold bath and allow to remain for 15 minutes. Repeat the cycle as indicated for the specific test level. A dye may be used to observe any gross penetration.

Bath volume, or temperature control, shall be such that bath temperature does not change by more than ±3 °C during the test cycle.

7.8.3 Evaluation. The radioactivity in the hot and cold baths shall be determined. The radioactivity in the liquid shall not exceed 1 microcurie for painted tritium sources, 50 nanocuries for gaseous tritium sources, or 5 nanocuries for other sources. See Section 8 for additional details.

8. Evaluation

Determination of compliance with the performance test requirements shall be made on all sources in accordance with the procedures described below, after the sources have been subjected to the entire test sequence. These evaluations shall be made in addition to the evaluation procedures specified for the individual tests.

8.1 The test sources shall be examined visually for any evidence of failure, visible leakage or degradation.

8.2 The test sources shall be subjected to brightness measurements and the loss of luminosity shall not exceed 20 percent of that observed prior to this series of tests.

8.3 The test sources shall be tested for loss (i.e. emersion) of radioactive contents as follows:

8.3.1 Each source shall be wet wipe tested. An acceptable wipe (smear) test consists of wiping all external surfaces of the source thoroughly with a piece of filter paper or other suitable material of high wet strength and absorbent capacity, moistened with a solvent which shall not attack the material of which the outer surfaces of the source are made and which, under the conditions of this test, has been demonstrated to be effective in removing the radionuclide involved. Measure the total activity on the paper. It shall not exceed 1 microcurie for painted tritium sources or 5 nanocuries for other sources. Wipe tests are not required for gaseous sources.

8.3.2 Each source shall be soak tested for 24 hours in a volume of water about equal to or greater than 10 times the volume of the source. The source shall be removed and the activity in the solution measured. The activity in the solution shall not exceed 1 microcurie for painted tritium sources, 50 nanocuries for gaseous tritium sources, or 5 nanocuries for other sources. Gaseous krypton sources are exempted from the soak test.

8.3.3 Leakage of gas from gaseous sources shall be monitored by enclosing the source in a closed system or through suitable means to determine rate of leakage. Leakage shall not exceed 5 nanocuries in 24 hours. Tritium sources shall be exempted from the test.

8.4 If intermediate emersion testing is performed as outlined in Sections 8.3.1 and 8.3.3, then return to the test sequence outlined in Section 8.3.

9. Additional Tests for Special Uses

Under certain environmental conditions, additional tests, not applicable to all sources, may be required or desirable. The

following covers one such additional test. Other additional tests should be developed and applied as special situations become evident.

9.1 Dust Resistance

9.1.1 Equipment. Humidity chamber, heat source, dusting chamber, carbon black, MgO_2 or other opaque powder.

9.1.2 Procedure. Prepare test sources as follows:

9.1.2.1 Rub surface of source to create surface charge. Dust source using the procedure described under Section 9.1.3.

9.1.2.2 Expose test source for one hour in air with a relative humidity of 95 percent to 100 percent. Dust source using the procedure described under Section 9.1.3.

9.1.2.3 Expose source for one hour in air at 80°C ± 10°C to drive plasticizer or residual solvent using the procedure described under Section 9.1.3.

9.1.3 Sources prepared under each procedure above should be mounted or suspended in the dusting chamber, in the position in which it is to be used, and dusted with opaque powder to simulate dust laden air, or atmosphere. Dusting powder should be introduced in an air stream, in such a manner that the air stream does not impinge directly on the translucent surface of the source but creates a dust suspension, resembling a dust laden atmosphere. Expose the source for thirty minutes in such an atmosphere.

9.1.4 Evaluation. Remove the source, without disturbing the surface, and measure brightness through any accumulated dust, or make such measurement without removing the source from the chamber. The loss of luminosity shall not be greater than 20 percent of pretest brightness.

10. Reference

American National Standards Institute/Health Physics Society (ANSI/HPS). 1997. Sealed Radioactive Sources – Classification. ANSI/HPS N43.6-1997. Health Physics Society, McLean, VA.

ISO 9002

CRT LABORATORIES, INC.
1680 North Main Street, Orange, CA 92867
(714) 283-2032 • (800) 597-LABS • Fax (714) 283-1365
www.crtlabs.com • e-mail: crtlabs@pacbell.net

ASTM Physical & Mechanical • Chemical-Thermal Analysis • IAPMO Cell Class
Geosynthetic Materials • Plumbing & Faucet Assemblies • Resin & Finished Product Testing

TEST REPORT

FOR: Best Lighting Products
201 E. Stevens Avenue
Santa Ana, CA 92707
Tel: (714) 432-0356 / Fax: (714) 432-7247
ATTN Mr. Maxwell Malone

LWR. NO.: 14302 DATE: 06/14/01

Background: Customer submitted one (1) sample for testing. The sample was received on 05/30/01 via customer delivery. Visual inspection was performed on 05/30/01 and no product defects were noted. The sample was submitted for conformance testing to ANSI/HPS N43.4-2000. Testing to be performed per quote signed on 06/03/01 with a verbal purchase order. Testing was performed by CRT personnel except radioactivity testing that was performed by Truesdail, a CRT approved source. The following additional information is provided:

CRT Order Entry Log Date: 05/30/01

Product Description: Tritium powered EXIT sign
Model No. FLXTU 1GW10
Maximum activity of one light source: 1.03 curies
Total activity: 7.1 curies
Classification: 3
Performance test level: 1-3-3-3-2-2-2

Prescribed Testing: Full certification to ANSI/HPS N43.4-2000

Procedure: All testing was performed consecutively in accordance with ANSI/HPS N43.4-2000:
Discoloration – Section 7.2 using a Q-Panel Q.U.V. weatherometer for 12 hrs.
Temperature test – Section 7.3 at (-) 30°C and (+) 65°C
Thermal shock – Section 7.4 at minus (-) 30°C to (+) 65°C
Reduced pressure – Section 7.5 at 175 mm Hg abs
Drop Impact – Section 7.6 20X at 1 m
Vibration – Section 7.7 at 0.075 cm, 10-55 Hz/min, 30 min
Immersion – Section 7.8 at 0°C and 65°C, 2X, radioactivity of water measured by EPA methods for drinking water

Summary of Results: The sample withstood the test sequence with no breakage of the glass tubes that contained the tritium gas. The loss of luminosity was 0% with a maximum loss requirement of 20%. The test results and observations are tabulated on the following page.

Conclusion: The sample ***conforms*** to ANSI/HPS requirements for Radioactive Self-Luminous Light Sources.

Specimen Retain Bin: #01 (30 day hold only)

CRT LABORATORIES, INC.
UL Approved-Registered / ISO 9002 Certified

Ken A. Le Jeune
Lab Director / President

Tom J. Parsons
General Manager

ISO 9002
A3133
Committed to Quality

CRT LABORATORIES, INC.
1680 North Main Street, Orange, CA 92867
(714) 283-2032 • (800) 597-LABS • Fax (714) 283-1365
www.crtlabs.com • e-mail: crtlabs@pacbell.net

ASTM Physical & Mechanical • Chemical-Thermal Analysis • IAPMO Cell Class
Geosynthetic Materials • Plumbing & Faucet Assemblies • Resin & Finished Product Testing

TEST REPORT PAGE 2 OF 2

FOR: Best Lighting Products
201 E. Stevens Avenue
Santa Ana, CA 92707
Tel: (714) 432-0356 / Fax: (714) 432-7247
ATTN Mr. Maxwell Malone

LWR. NO.: 14302 DATE: 06/14/01

TABLE 1
SAMPLE: Tritium powered EXIT sign
SCOPE: Testing to ANSI/NPS N43.4-2000

Section	Determination	Observations	Requirements
7.2	Initial luminosity	1.6 lux	Not specified
	Discoloration	No discoloration or other effects observed	No discoloration or other effects in the test sources
	Subsequent luminosity	1.6 lux 0% change	20% maximum
7.3	Temperature test	The white plastic outside frame of the unit yellowed during elevated temperature testing in the area where it was exposed to UV light. There was no evidence of failure in the test sources.	No evidence of failure in the test sources
7.4	Thermal shock	There was no evidence of failure in the test sources.	No evidence of failure in the test sources
7.5	Reduced pressure	There was no evidence of failure in the test sources.	No evidence of failure in the test sources
7.6	Drop Impact	The plastic outside frame became dislodged during all drops except flat on the face or back. The source on the trunk of "T" came loose in its mounting on the 12th drop. After each drop, the unit was examined and reassembled. The unit was dropped twice on each edge, corner and face. There was no evidence of failure in the test sources.	No evidence of failure in the test sources
7.7	Vibration	The plastic outside frame developed a small crack in the face inside corner. The long source on the "X" came loose in its mounting on the 2nd cycle. There was no evidence of failure in the test sources.	No evidence of failure in the test sources
7.8	Immersion	Radioactivity, gross alpha (nanocuries/liter): Cold water Hot water Blank	50 nanocuries maximum <0.01 <0.01 <0.01
8.1	Visual examination	There was no evidence of failure, visible leakage, or degradation in the test sources.	No evidence of failure, visible leakage, or degradation in the test sources.
8.2	Brightness	Final luminosity is 1.6 lux yielding 0% change subsequent to all tests of Section 7.	20% maximum
8.3	Radioactive content loss	Section 8.3.1 wipe tests and 8.3.2 soak tests are not required for gaseous sources. Section 8.3.3 is not required for tritium sources.	Not applicable

Underwriters Laboratories Inc.®

1655 Scott Boulevard
Santa Clara, California 95050-4169
United States Country Code (1)
(408) 985-2400
FAX No. (408) 296-3258
http://www.ul.com

02SC08930
E229413 (FWBX)

August 21, 2002

Best Lighting Products
Los Vegas, NV

Fax: 702-644-0347

Attention: Mr. Maxwell Malone

Subject: UL Evaluation of Tritium Exit Sign, Model SLXTU Series,

Dear Mr. Malone,

UL's evaluation of your product has been completed under project number 02SC08930, and the subject product was determined to comply with the applicable requirements of UL 924, the Standard for Emergency Lighting and Power Equipment, Eighth Edition.

If you have any comments or questions, please do not hesitate to contact us.

Regards,

Abdul Ahad

ABDUL AHAD (Ext. 31979)
Associate Project Engineer
Conformity Assessment Services
Section 3016I